Report on the FCC and IC Testing of the EUCHNER GmbH + Co. KG CTS In accordance with RSS-Gen and RSS-102

Prepared for: EUCHNER GmbH + Co. KG
Kohlhammerstraße 16
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Product Service

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COMMERCIAL-IN-CONFIDENCE

Date: 2022-04-28
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RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Project Management	Patrick Müller	2022-04-28	*SIGN-ID 643858* **Patrick Müller**
Authorised Signatory	Alex Fink	2022-04-28	*SIGN-ID 644041*

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD Product Service document control rules.

ENGINEERING STATEMENT
The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate compliance with RSS-102. The sample tested was found to comply with the requirements defined in the applied rules.

RESPONSIBLE FOR	NAME	DATE	
Testing	Patrick Müller	2022-04-28	*SIGN-ID 643859* **Patrick Müller**

Laboratory Accreditation	Laboratory recognition	ISED Canada test site registration
DAkkS Reg. No. D-PL-11321-11-03 DAkkS Reg. No. D-PL-11321-11-04	Registration No. BNetzA-CAB-16/21-15	3050A-2

EXECUTIVE SUMMARY
A sample of this product was tested and found to be compliant with RSS-102, Issue 5 (03-2015)

ACCREDITATION
Our BNetzA Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our BNetzA Accreditation.

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Product Service

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1 Report Summary

1.1 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

Issue	Description of Change	Date of Issue
1	First Issue	2022-04-21

Table 1

1.2 Introduction

Applicant	EUCHNER GmbH + Co. KG
Manufacturer	EUCHNER GmbH + Co. KG
Model Number(s)	CTS
Serial Number(s)	125
Hardware Version(s)	V4
Software Version(s)	V1.0.1.1
Additional information	---
Number of Samples Tested	1
Test Specification/Issue/Date	RSS-102, Issue 5 (03-2015)
Test Plan/Issue/Date	NA
Order Number Date	5565404 2021-11-25
Date of Receipt of EUT	2021-12-01
Start of Test	2021-12-08
Finish of Test	2022-04-21
Name of Engineer(s)	Patrick Müller
Related Document(s)	RSS-102, Issue 5 (03-2015)

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1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with RSS-102 is shown below.

Section	Specification Clause	Test Description	Result	Comments/Base Standard
Configuration and Mode: Continuously transmitting				
2.1	2.51	Exemption Limits for Routine Evaluation – SAR Evaluation	Pass	RSS-102, Issue 5 (03-2015)

Table 2

Product Service

1.4 Product Information

Type designation:	CTS
Type of equipment:	Non-contact safety switch
Power supply:	24 Vdc
Kind of equipment:	Transceiver
Frequency range:	125 KHz
Number of RF-Channels:	1
Channel spacing:	---
Temperature range:	-20°C-55°C

1.4.1 Technical Description

The CTS is an encoded non-contact safety switch with interlocking and guard locking monitoring, which alternatively provides a safe door position monitoring or a safe guard locking monitoring.
The door position detection uses the principle of RFID.

1.4.2 Placement of Antenna

The antenna is placed within the housing.

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1.5 EUT Modification Record

The table below details modifications made to the EUT during the test programme.
The modifications incorporated during each test are recorded on the appropriate test pages.

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
0	As supplied by the customer (S/N: 125)	Not Applicable	Not Applicable

Table 3

1.6 Test Location

TÜV SÜD Product Service conducted the following tests at our Straubing Test Laboratory.

Test Name	Name of Engineer(s)
Configuration and Mode: Continuously transmitting	
RF Exposure Assessment	Patrick Müller

Table 4

Office Address:

Äußere Frühlingstraße 45
94315 Straubing
Germany

Product Service

2 Test Details

2.1 Exposure of Humans to RF Fields

2.1.1 Specification Reference

IC RSS-GEN Issue 4, section 3.2 and
IC RSS-102, Issue 5, section 2.5

2.1.2 Guide

IC RSS-102 Issue 5, section 2.5

2.1.3 Equipment Under Test and Modification State

CTS, S/N: 125 - Modification State 0

2.1.4 Date of Test

2021-12-08 to 2022-04-21

2.1.5 Test Results

Product Service

RFID Evaluation:

Exposure of Humans to RF Fields	Applicable	Declared by applicant	Measured	Exemption
The antenna is				
☐ detachable				
The conducted output power (CP in watts) is measured at the antenna connector: CP = **..... W**			☐	
The effective isotropic radiated power (EIRP in watts) is calculated using				
☐ the numerical antenna gain: G = **.....**		☐		
$EIRP = G \cdot CP \Rightarrow EIRP$ = **..... W**				
☐ the field strength[1] in V/m: FS = **..... V/m**			☐	
$EIRP = \frac{(FS \cdot D)^2}{30} \Rightarrow EIRP$ = **..... W**				
with:				
Distance between the antennas in m: D = **..... m**			☐	
☒ not detachable				
A field strength measurement is used to determine the effective isotropic radiated power (EIRP in watts) given by: $EIRP = \frac{(FS \cdot D)^2}{30} \Rightarrow EIRP$ = **0.135 µW**				
with:				
Field strength in V/m: FS = **0.00067**			☒	
Distance between the two antennas in m: D = **3**			☒	
Selection of output power				
The output power TP is the higher of the conducted or effective isotropic radiated power (e.i.r.p.): TP = **0.135 µW**				

[1] The conversion formula is valid only for properly matched antennas. In other cases the transmitter output power may have to be measured by a terminated measurement when applying the exemption clauses.
If an open area test site is used for field strength measurement, the effect due to the metal ground reflecting plane should be subtracted from the maximum field strength value in order to reference it to free space, before calculating TP.

Product Service

Exposure of Humans to RF Fields (continued)		Applicable	Declared by applicant	Measured	Exemption
Separation distance between the user and the transmitting device is					
☒ less than or equal to 20 cm	☐ greater than 20 cm		☐		
Transmitting device is					
☐ in the vicinity of the human head	☐ body-worn		☐		

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SAR evaluation														
SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in the table. For controlled use devices where the 8 W/kg for 1 gram of tissue applies, the exemption limits for routine evaluation in the table are multiplied by a factor of 5. For limb-worn devices where the 10 gram value applies, the exemption limits for routine evaluation in the table are multiplied by a factor of 2.5. If the operating frequency of the device is between two frequencies located in the table, linear interpolation shall be applied for the applicable separation distance. For test separation distance less than 5 mm, the exemption limits for a separation distance of 5 mm can be applied to determine if a routine evaluation is required. For medical implants devices, the exemption limit for routine evaluation is set at 1 mW. The output power of a medical implants device is defined as the higher of the conducted or e.i.r.p to determine whether the device is exempt from the SAR evaluation.														
Frequency (MHz)	Exemption limits (mW)[2] at separation distance of													
	≤5 mm	10 mm	15 mm	20 mm	25 mm	30 mm	35 mm	40 mm	45 mm	≥50 mm				
≤300 [3]	71	101	132	162	193	223	254	284	315	345				
450	52	70	88	106	123	141	159	177	195	213				
835	17	30	42	55	67	80	92	105	117	130				
1900	7	10	18	34	60	99	153	225	316	431				
2450	4	7	15	30	52	83	123	173	235	309				
3500	2	6	16	32	55	86	124	170	225	290				
5800	1	6	15	27	41	56	71	85	97	106				

[2] The exemption limit in the table are based on measurements and simulations on half-wave dipole antennas at separaton distances of 5 mm to 25 mm from a flat phantom, providing a SAR value of approximately 0.4 W/kg for 1 g of tissue. For low frequencies (300 MHz to 835 MHz), the exemption limits are derived from alinear fit. For high frequencies (1900 MHz and above), the exemption limits are derived from athird order polynomial fit.

[3] Transmitters operating between 3 kHz and 10 MHz, meeting the exemption from routine SAR evaluation, shall demonstrate compliance to the instantaneous limits in IC RSS-102, issue 5, section 4.

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Carrier frequency:	*f*	=	**125 kHz**			
Distance:	*d*	=	**5 mm**			
Transmitter output power:	*TP*	=	**0.135 µW**			
Limit:	TP_{limit}	=	**71 mW**			☒
☐ SAR evaluation is documented in test report no.						

Specifications:	RSS-102, Issue 5, Section 4, Table 4, Uncontrolled Environment SPR-002, Issue 1
Operation mode:	24 Vdc Supply – Continuously transmitting
Comment:	The nerve stimulation exposure limit is defined for the frequency range 3 kHz to 10 MHz, only. Thus, the carrier at 125 kHz was evaluated, only.

Test procedure:	IEC 62311, Section 7.2 “Measurement to show accordance to the reference levels”
Test distance:	Direct contact to EUT
Limit:	*Frequency Range (MHz)* / *Electric Field (V/m_{rms})* / *Magnetic Field (A/m_{rms})* / *Peference Periode (min)* 0.003 – 10 / 83 / 90 / Instantaneous 0.1 – 10 / --- / 0.73 / f / 6 1.1 - 10 / $87/f^{0.5}$ / --- / 6 *f* in MHz
Test positions:	All surfaces: The antenna was moved all over the equipment under test using a test distance as stated above.

Measured maximum value (V/m)	*Maximum Limit at 125 kHz (V/m)*	*Margin to reference value (V/m)*
2.65	83.00	80.35

Measured maximum value (A/m)	*Maximum Limit at 125 kHz (A/m)*	*Margin to reference value (A/m)*
0.0322	90.00	89.97

Measured average value (A/m)	*Average Limit at 125 kHz (A/m)*	*Margin to reference value (A/m)*
0.0164	5.84	5.8236

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2.1.6 Test Location and Test Equipment Used

This test was carried out in a Shielded room - cabin no. 4. and no. 11.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Electromagnetic radiation meter	Narda Safety	EMR-200	19590	36	2022-11-30
Electric field probe	Narda Safety	Type 8.3	19591	36	2022-11-30
Magnetic field probe	Narda Safety	Type 12.1	19592	36	2022-11-30
EMI test receiver	Rohde & Schwarz	ESW44	39897	12	2023-04-30
EMC measurement software	Rohde & Schwarz	EMC32-ME+	19719	N/A	N/A

Table 5

Product Service

3 Measurement Uncertainty

For a 95% confidence level. the measurement uncertainties for defined systems are:

Radio Testing			
Test Name	kp	Expanded Uncertainty	Note
Occupied Bandwidth	2.0	±1.14 %	2
RF-Frequency error	1.96	±1 · 10-7	7
RF-Power. conducted carrier	2	±0.079 dB	2
RF-Power uncertainty for given BER	1.96	+0.94 dB / -1.05	7
RF power. conducted. spurious emissions	1.96	+1.4 dB / -1.6 dB	7
RF power. radiated			
25 MHz – 4 GHz	1.96	+3.6 dB / -5.2 dB	8
1 GHz – 18 GHz	1.96	+3.8 dB / -5.6 dB	8
18 GHz – 26.5 GHz	1.96	+3.4 dB / -4.5 dB	8
40 GHz – 170 GHz	1.96	+4.2 dB / -7.1 dB	8
Spectral Power Density. conducted	2.0	±0.53 dB	2
Maximum frequency deviation			
300 Hz – 6 kHz	2	±2.89 %	2
6 kHz – 25 kHz	2	±0.2 dB	2
Maximum frequency deviation for FM	2	±2.89 %	2
Adjacent channel power 25 MHz – 1 GHz	2	±2.31 %	2
Temperature	2	±0.39 K	4
(Relative) Humidity	2	±2.28 %	2
DC- and low frequency AC voltage			
DC voltage	2	±0.01 %	2
AC voltage up to 1 kHz	2	±1.2 %	2
Time	2	±0.6 %	2

Table 6

Radio Interference Emission Testing			
Test Name	kp	Expanded Uncertainty	Note
Conducted Voltage Emission			
9 kHz to 150 kHz (50Ω/50µH AMN)	2	± 3.8 dB	1
150 kHz to 30 MHz (50Ω/50µH AMN)	2	± 3.4 dB	1
100 kHz to 200 MHz (50Ω/5µH AMN)	2	± 3.6 dB	1
Discontinuous Conducted Emission			
9 kHz to 150 kHz (50Ω/50µH AMN)	2	± 3.8 dB	1
150 kHz to 30 MHz (50Ω/50µH AMN)	2	± 3.4 dB	1
Conducted Current Emission			
9 kHz to 200 MHz	2	± 3.5 dB	1
Magnetic Fieldstrength			
9 kHz to 30 MHz (with loop antenna)	2	± 3.9 dB	1
9 kHz to 30 MHz (large-loop antenna 2 m)	2	± 3.5 dB	1
Radiated Emission			
Test distance 1 m (ALSE)			
9 kHz to 150 kHz	2	± 4.6 dB	1
150 kHz to 30 MHz	2	± 4.1 dB	1
30 MHz to 200 MHz	2	± 5.2 dB	1
200 MHz to 2 GHz	2	± 4.4 dB	1
2 GHz to 3 GHz	2	± 4.6 dB	1
Test distance 3 m			
30 MHz to 300 MHz	2	± 4.9 dB	1
300 MHz to 1 GHz	2	± 5.0 dB	1
1 GHz to 6 GHz	2	± 4.6 dB	1
Test distance 10 m			
30 MHz to 300 MHz	2	± 4.9 dB	1
300 MHz to 1 GHz	2	± 4.9 dB	1
Radio Interference Power			
30 MHz to 300 MHz	2	± 3.5 dB	1
Harmonic Current Emissions			4
Voltage Changes. Voltage Fluctuations and Flicker			4

Table 7

Product Service

Immunity Testing			
Test Name	kp	Expanded Uncertainty	Note
Electrostatic Discharges			4
Radiated RF-Field			
Pre-calibrated field level	2	+32.2 / -24.3 %	5
Dynamic feedback field level	2.05	+21.2 / -17.5 %	3
Electrical Fast Transients (EFT) / Bursts			4
Surges			4
Conducted Disturbances. induced by RF-Fields			
via CDN	2	+15.1 / -13.1 %	6
via EM clamp	2	+42.6 / -29.9 %	6
via current clamp	2	+43.9 / -30.5 %	6
Power Frequency Magnetic Field	2	+20.7 / -17.1 %	2
Pulse Magnetic Field			4
Voltage Dips. Short Interruptions and Voltage Variations			4
Oscillatory Waves			4
Conducted Low Frequency Disturbances			
Voltage setting	2	± 0.9 %	2
Frequency setting	2	± 0.1 %	2
Electrical Transient Transmission in Road Vehicles			4

Table 8

Note 1:
The expanded uncertainty reported according to CISPR 16-4-2:2003-11 is based on a standard uncertainty multiplied by a coverage factor of kp = 2. providing a level of confidence of p = 95.45%
Note 2:
The expanded uncertainty reported according to UKAS Lab 34 (Edition 1. 2002-08) is based on a standard uncertainty multiplied by a coverage factor of kp = 2. providing a level of confidence of p = 95.45%
Note 3:
The expanded uncertainty reported according to UKAS Lab 34 (Edition 1. 2002-08) is based on a standard uncertainty multiplied by a coverage factor of kp = 2.05. providing a level of confidence of p = 95.45%
Note 4:
It has been demonstrated that the used test equipment meets the specified requirements in the standard with at least a 95%confidence.
Note 5:
The expanded uncertainty reported according to IEC 61000-4-3 is based on a standard uncertainty multiplied by a coverage factor of kp = 2. providing a level of confidence of p = 95.45%
Note 6:
The expanded uncertainty reported according to IEC 61000-4-6 is based on a standard uncertainty multiplied by a coverage factor of kp = 2. providing a level of confidence of p = 95.45%
Note 7:
The expanded uncertainty reported according ETSI TR 100 028 V1.4.1 (all parts) to is based on a standard uncertainty multiplied by a coverage factor of kp = 1.96. providing a level of confidence of p = 95.45%
Note 8:

Product Service

The expanded uncertainty reported according to ETSI TR 102 273 V1.2.1 (all parts) is based on a standard uncertainty multiplied by a coverage factor of kp = 1.96. providing a level of confidence of p = 95.45%